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| <p>(54) Title: MALE URETHRAL CATHETER SIZING AND INSERTION METHOD</p> <p>(57) Abstract</p> <p>An indwelling urethral catheter sizing system comprises sets of substantially equal length indwelling urethral catheters (14) having various balloon spacings (a, b, c), from bladder balloons (2) to urethral anchoring cuff balloons (36). A method of implanting an indwelling urethral catheter from the sets involves first determining a patient's interballoon urethral segment length, from his bladder to his bulbous urethra immediately downstream of what remains of his prostate gland. A urethral sizing catheter having a balloon spacing corresponding to the interballoon urethral segment length is inserted in the patient to determine the clinical length of the patient's urethral tract from his bladder to his penile meatus. A male indwelling urethral catheter is then chosen from the sets having a balloon spacing corresponding to the patient's interballoon urethral segment length and the clinical length determined with the urethral sizing catheter. The urethral sizing catheter can be used for filling and voiding the bladder.</p> <div data-bbox="876 1092 1396 1911"> </div> |                  |   |

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## MALE URETHRAL CATHETER SIZING AND INSERTION METHOD

## BACKGROUND OF THE INVENTION

5 This invention relates to urethral catheters and more specifically to a male indwelling urethral catheter which, after it is inserted and anchored into position, does not extend beyond a patient's penile meatus and allows the patient to urinate in a substantially normal manner.

10 Indwelling urethral catheters of the type to which this invention relates were first disclosed in U.S. patent no. 4,350,161 to Richard C. Davis, Jr. A common feature of such catheters is a valve which, when the catheter is properly anchored in the patient's urethra,  
15 is positioned in the patient's penile urethra and can be activated by application of a force external to the penis. A further feature of such a catheter is that it is dimensioned and installed so that its downstream tip does not extend beyond the penis meatus in any patient  
20 position. As is set forth in U.S. patent 4,350,161 of Richard C. Davis, Jr. a method of inserting such an indwelling urethral catheter includes the step of determining the length of the patient's urethral tract from his bladder to his penile meatus. Thus, since the  
25 advent of the indwelling urethral catheter of the type described above, proper sizing of the catheter has always been appreciated as a critical element in a protocol for positioning the device and in its proper function.

30 During development of this catheter it has come to be better appreciated that as a body moves, a bladder and urethra shift and stretch relative to one another. It has been determined that overall urethral length is generally shortest when a patient is lying down and  
35 lengthens when the patient is sitting or standing. Thus, it has been determined that a properly sized male indwelling urethral catheter of this type must be short

enough to remain totally inside the patient's urethra in all positions, but yet long enough to allow easy access to the valve located in the patient's penile urethra for voiding and for removal of the catheter itself.

5 If it is sized too long, the catheter may occasionally protrude from the tip of the penis, potentially causing pain, swelling, and infection. If the catheter is too short, the patient may not be able to easily access the valve to properly actuate it.  
10 Further, the patient may have difficulty removing the catheter.

Another feature of the indwelling urethral catheter described in patent no. 4,350,161 to Richard C. Davis, Jr. is that it includes not only a bladder balloon but  
15 also an anchoring urethral cuff balloon along a catheter drainage shaft for inflating in the patient's urethra. A primary purpose of the urethral anchoring cuff balloon, as was described in U.S. patent 4,350,161, is to prevent retrograde movement of the catheter into the  
20 bladder by using the prostatic urethra as a buttress against which the urethral anchoring cuff balloon is juxtaposed.

To meet different lengths of normal adult urethral tracts, indwelling urethral catheters of the type of  
25 this invention, have been, to date, manufactured in six different lengths so that most any length of an adult male penis and urethral tract can be accommodated. However, notwithstanding this, sizing problems continue to be encountered. In this regard, until recently, an  
30 indwelling urethral catheter of the type of this invention was fitted to a patient by first placing a measuring catheter, having a bladder balloon and drainage shaft extending beyond the patient's penile meatus, in the patient. By noting the position of the  
35 penile meatus along the measuring catheter's drainage shaft, with the patient in various positions, the

5 overall length of the patient's urethral tract was  
determined. An indwelling urethral catheter was then  
chosen from the six different lengths corresponding to  
the overall length of the patient's urethral tract.  
10 Using this method, however, problems have continually  
been encountered in choosing the proper length  
catheters. That is, after catheters, whose lengths were  
determined as described above, have been installed it  
has been found that they often have not remained in  
15 their preferred positions. In some cases they have  
shifted downstream to extend beyond a patient's penile  
meatus when the patient was in a lying position and in  
other cases they have shifted upstream so far from the  
meatus that the patient has not been able to activate  
20 the valve to urinate. Because of this, it has sometimes  
been necessary to try various size catheters in a  
patient, one after the other -- even though the patient  
was previously measured -- until a catheter of the  
correct size, if ever, was found. Thus, in many cases,  
25 catheter sizes have actually been determined as much by  
trial and error as by measuring, if at all. Such trial  
and error has resulted in discomfort for patients and  
has proven to be expensive, since it has resulted in the  
expenditure of many catheters and much time and effort;  
and often patients were not able to be fitted at all.

30 The problem has been that some inserted indwelling  
urethral catheters, of the type of this invention, have  
experienced undue linear movement along urethral tracts.  
That is, sometimes they have appeared to be in their  
correct positions but then at other times they have  
35 moved linearly, within the urethral tract, to  
inappropriate positions. Thus, when some catheters were  
initially sized using the above-described method, which  
relied solely on the bladder-to-meatus length, they were  
occasionally noted to shift downstream in the urethra;  
thereby appearing to be "too long", and their tips

intermittently protruded from the penile meatus. It has been assumed that such shifting represented "device failure"; presumably the bladder balloon had leaked thus allowing downstream migration. An opposite situation has been noted in some patients who at first could easily access their valves but who, over time, had increasing difficulty accessing their valves because their catheters migrated upstream. Again, this was previously interpreted as a "device failure" whereby the urethral anchoring cuff balloon was thought to have deflated allowing such upstream migration.

Therefore, it is an object of this invention to provide a system of urethral sizing, or measuring, catheters and a method of its use, which allows accurate measuring of the length of a patient's urethral tract so that an appropriate-length indwelling urethral catheter can be chosen which fits the patient's urethral tract.

Similarly, it is an object of this invention to provide a method for measuring a patient's urethral tract for determining an appropriate clinical length of a indwelling urethral catheter which is accurate, uncomplicated, fast, and not unduly expensive. It is also an object of this invention to provide a system of indwelling urethral catheters which includes sets of urethral catheters of substantially the same lengths but having different features for accommodating patients with different urethral anatomies which vary due to their preexisting clinical conditions.

#### SUMMARY

According to principles of this invention, it has been determined that a cause of this linear shifting is that an anchoring urethral cuff balloon prefers to reside in the bulbous urethra, regardless of its position. It has been thus determined that not only must the overall urethral length be considered, but the distance between the bladder neck orifice and the

bulbous urethra is also critical. This distance is referred to herein as the interballoon urethral segment length.

Further according to principles of this invention, an indwelling urethral catheter system and method of its use involves sets of catheters having substantially the same lengths, but having bladder balloons and urethral anchoring cuff balloons spaced differently from one another in order to accommodate various interballoon urethral segment lengths of patients. Both urethral sizing catheters and indwelling urethral catheters include sets of catheters with variously spaced bladder and urethral-anchoring-cuff balloons.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described and explained in more detail below using the embodiments shown in the drawings. The described and drawn features, in other embodiments of the invention, can be used individually or in preferred combinations. The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings in which reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating principles of the invention in a clear manner.

Fig. 1 is a schematic lengthwise, partially cross-sectional, partially-exploded, view of a single urethral sizing catheter of a set of urethral sizing catheters of this invention when mounted in a patient, with possible prostate sizes being indicated thereon diagrammatically;

Figs. 2A-2C are truncated schematic lengthwise cross-sectional views depicting urethral sizing catheters of a urethral sizing catheter set of this

invention with a penis being shown schematically on each of them in cross-section; and,

Figs. 3A-3C are schematic lengthwise cross-sectional views depicting indwelling urethral catheters of a set of this invention with a penis being shown schematically on each of them in cross-section.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT

This invention is based on the realization that the distance between the bladder neck orifice and the bulbous urethra, which shall be referenced herein as the "interballoon urethral segment length" and as the "prostatic urethral length", varies tremendously among patients. Such a difference in interballoon urethral segment lengths is illustrated in Fig. 1 where are shown diagrammatically: a patient's bladder 10, the patient's penis 12, and a urethral sizing catheter 14 extending through a urethral tract 16 from the bladder 10 to beyond a penile meatus 18. For purposes of illustration, three different size interballoon urethral segment lengths (i.e. prostate gland or prostate Fossa as the case may be) are represented diagrammatically on Fig. 1. It should be understood that individual patients will have only one of these interballoon urethral segment lengths; however, all three are depicted on Fig. 1 so that a reader can compare the different size interballoon urethral segment lengths with the interballoon spacing (balloon spacing) of a most-often-used (or normal size) sizing catheter and the corresponding indwelling urethral catheter.

A normal-size prostate gland 20 has a downstream side 22 which is located approximately four centimeters from the interior surface of a bladder neck orifice 10a (or downstream side 24 of a bladder balloon 26). This four centimeter spacing is represented by the letter "b" in Fig. 1. However, an enlarged, or hypertrophic prostate gland 28 has a downstream side 30 which is



spaced approximately 5.5cm from the downstream side 24  
of the bladder balloon 26 in the bladder 10. This 5.5cm  
measurement is signified by the letter "a" in Fig. 1.  
Finally, a post prostatectomy prostatic Fossa 32, which  
is essentially what is left when a prostate is removed  
(or at least diminished), has a downstream side 34 which  
is spaced approximately 2.0cm from the downstream side  
24 of the bladder balloon 26 when it is in the bladder  
10. This downstream side of the bladder balloon 26 can  
also be influenced to some extent by the position of the  
bulbous urethra. In this regard, when a patient's  
prostate is removed, it sometimes happens that some of  
the bladder must also be removed and reconstructed. In  
this process, these elements move relative to one  
another to some extent.

In any event, this 2.0cm measurement is indicated  
by the letter "c" in Fig. 1. It should be understood  
that these measurements are only given as approximations  
and that they can vary significantly from patient to  
patient. However, it can be seen from these  
approximations, in Fig. 1, that the relative  
interballoon urethral segment lengths ("b", "a", & "c")  
of patients -- and thus necessary catheter balloon  
spacings -- can vary by a factor of nearly three  
(comparing "a" with "c").

The urethral sizing catheter 14 is shown as having  
a urethral anchoring cuff balloon 36 which is spaced  
along a shaft 38 of the catheter 14 from the downstream  
side 24 of the bladder balloon 26 thus defining a  
catheter interballoon distance. Thus, the overall  
upstream structure of the bladder balloon 26 and the  
urethral anchoring cuff balloon 36 for this sizing  
catheter 14 is quite similar to that of an indwelling  
urethral catheter of the type with which this invention  
relates.

The bladder balloon 26 and the urethral anchoring

cuff balloon 36, shown in Fig. 1, are spaced from one another a correct amount to appropriately anchor the urethral sizing catheter 14 on the normal-size prostate gland 20, which it inflatingly engages. That is, when the bladder balloon 26 and the urethral anchoring cuff balloon are inflated, as shown, they apply pressure to opposite sides of the normal-size prostate gland 20 for holding the urethral sizing catheter 14 against retrograde movement (up into the bladder 10) and against downstream movement (out of the penile meatus 18).

According to this invention, if the patient had an enlarged prostate gland 28, or a missing prostate gland 32 as a result of having prostatectomy surgery, a different respective urethral sizing catheter 14 would be selected, one with its catheter interballoon distance being appropriate so that the balloons impinge on opposite sides of the prostate gland, or prostate fossa as the case may be, on which the urethral sizing catheter is to be mounted. In all cases, however, the urethral anchoring cuff balloon resides in the bulbous urethra. In the past, all sizing catheters have had essentially the same balloon configuration. Further, all indwelling urethral catheters have had essentially the same interballoon distance configuration. The urethral sizing catheter 14, in addition to having two inflation lumens 37a, 37b -- for inflating the bladder balloon 26 and the urethral anchoring cuff balloon 36 through Robert's valves 37c (see U.S. Patent 5,041,092 to Barwick as well as the previously-described U.S. Patent 4,350,161 to Davis for such disclosures) -- has a drainage/filling lumen 38a which connects bladder openings 40 with an exterior opening 42 (these elements being shown schematically). Using this drainage/filling lumen 38a of the urethral sizing catheter 14, the bladder 10 can be filled and voided.

Further, the urethral sizing catheter 14 has

graduation indicia 44 along its length so that one can "read" the position of the penile meatus 18 along the catheter shaft 38 for determining the appropriate overall clinical length of an indwelling urethral catheter while the patient moves throughout a series of positions and ranges of motion.

Figs. 2A-2C depict a set of urethral sizing catheters 14a-14c. As can be seen in Figs. 2A-2C each urethral sizing catheter of this set has a different interballoon spacing (interballoon) between the bladder balloon 26 and the respective urethral anchoring cuff balloon 36a-c corresponding to a different interballoon urethral segment length "a", "b", "c", thus defining 3 different interballoon spacings.

Figs. 3A-C depict respectively three different indwelling urethral catheters 46a, 46b, 46c of a urethral catheter set. Each of the catheters 46a-46c of the indwelling urethral catheter set generally has a drainage lumen communicating with bladder openings 48 in a Murphy tip 54, a valve 50 for controlling flow through the drainage lumen, and two inflation lumens (not shown) for inflating the bladder balloon 52 and the urethral anchoring cuff balloon 53a-c. The details of this catheter are not described herein inasmuch as the details do not relate to this invention. However, details of such male indwelling urethral catheters can be found in U.S. Patents 4,350,161; 5,041,092; and, 4,932,938.

In any event, it can be seen that each of the indwelling urethral catheters of the set depicted in Figs. 3A-C has approximately the same overall urethral length L. However, the respective spacings between the bladder balloons 52 and the urethral anchoring cuff balloons 52a-c corresponding to interballoon urethral segment lengths a, b, c are quite different for each member of the set.

Describing now a method of fitting an indwelling urethral catheter of the type of this invention to a patient, an investigator first determines a patient's interballoon urethral segment length. The investigator does this by examining the patient's medical history to determine if the patient's prostate gland has not been removed. If the prostate gland has not been removed, the investigator determines the size of the patient's prostate gland indirectly by rectal exam or directly by measuring the length of the prostatic urethra using cystoscopic or ultrasonic methods. By doing this the investigator can then determine which of the urethral sizing catheters 36a-c depicted respectively in Figs. 2A-2C (the one with a balloon spacing corresponding to the interballoon urethral segment length of the patient) should be used. The investigator then:

1. With the patient recumbent, washes the patient's penis and swabs it with a Betadine solution using standard sterile techniques and prepping procedures.

2. Applies an anesthetic lubricant to the urethral sizing catheter 36a, 36b or 36c which has been chosen and inserts the catheter, Murphy tip 54 first, into the patient's bladder through the patient's urethral meatus 18. The bladder balloon 26 is inflated with a volume of sterile saline solution through an inflation valve (not shown) and an inflation lumen (not shown) and a gentle external axial traction is applied to the catheter to snug the bladder balloon 26 against a base of the bladder neck orifice 10a.

3. While applying continual axial traction, a volume of sterile saline is instilled through the inflation (Roberts) valve, thus inflating the urethral anchoring cuff balloon 36a, 36b, or 36c in the patient's bulbus urethra 56 (Fig. 1) to the point of mild discomfort for the patient. (Note that the bulbous

urethra is always the preferred anchoring position of the anchoring cuff balloon 36a-c within the urethra).

4. The bladder 10 is then slowly instilled with a volume of sterile saline through the drainage/filling lumen 38a of the urethral sizing catheter 14a, 14b or 14c. The drainage lumen is then occluded with a plug 38b (shown schematically) and the patient is observed from a few minutes up to as long as several days. In some cases it is necessary to fill and void bladders a number of times in order to condition patients who have not had full bladders for a long time, for example.

5. Once the patient is able to tolerate the urethral sizing catheter with a full bladder, without discomfort, leakage, spasms, or other difficulties, the operator reads and notes the patient's overall clinical urethral length from the graduation indicia 44 on the urethral sizing catheter at the penile meatus 18 when the patient is in prone, sitting, and standing positions, with little or no traction on the catheter. If any difficulties in the patient are noted, adjustment in balloon volumes can be made to "custom-fit" it for a given patient. The volumes used for inflating the balloons for achieving particular graduation-indicia readings are also noted. The urethral sizing catheter is then removed (after voiding the bladder) by deflating the bladder balloon 26 and the urethral anchoring cuff balloon 36a, 36b or 36c and the urethral sizing catheter is withdrawn from the patient's penis by applying gentle axial traction.

6. An indwelling urethral catheter is selected 46a, 46b or 46c having a balloon spacing between its bladder balloon 52 and its urethral anchoring cuff balloon 53a, b, or c which corresponds to the interballoon urethral segment length "a", "b" or "c" as determined above. As stated above, the interballoon

urethral segment length "a" normally corresponds to a patient with an enlarged prostate gland, the interballoon urethral segment length "b" normally corresponds to a patient with a normal size prostate gland, and the interballoon urethral segment length "c" normally corresponds to a patient who has had his prostate removed. However, there also exists variations, modifications, and exceptions to these 3 general categories. The catheter chosen also has a length which corresponds to the graduation-indicia reading taken on the urethral sizing catheter. That is, the catheter chosen when inserted and anchored in the patient, would not quite extend along the urethra to the graduation-indicia reading, in all positions of the patient, but yet its downstream tip (and its evacuation valve) are relatively close to the penile meatus in all positions of the patient.

7. The indwelling urethral catheter which has been selected is then inserted and its bladder balloon 52 and urethral anchoring cuff balloon 53a, b or c are inflated sequentially in that order, with the identical volumes as were determined by the sizing catheter.

Sizing is usually required only once and this procedure accurately and efficiently accomplishes a correct sizing of an indwelling urethral catheter on an initial insertion nearly every time. The entire procedure requires less than five minutes, is only slightly uncomfortable, and should not be painful for patients.

Further, any "mis-sizing" of the indwelling urethral catheter will usually be noted immediately after the indwelling urethral catheter has been placed and is certain to be observed within minutes (not days) once the patient is observed to void and to ambulate around the office.

In the past, it has only been necessary to have one

type of urethral sizing catheter and six different lengths of indwelling urethral catheters. However, with this new system, it is anticipated that there will be at least three different sizes of urethral catheters, each having approximately the same length but each having different balloon spacings to accommodate the different interballoon urethral segment lengths. Further, it is anticipated that there will now be up to 18 different indwelling urethral catheter sizes. That is, there will still be up to six different overall clinical catheter lengths, but for each length there will be a set of at least three different balloon spacings to accommodate various interballoon urethral segment lengths of patients.

It will be appreciated by those of ordinary skill in the art that the method of determining the proper size indwelling urethral catheter, and the unique indwelling urethral catheter sets themselves, of this invention significantly reduce the chance of linear shifting within a urethra, thus improving the operation of male indwelling urethral catheters as well as reducing the time required for sizing them and decreasing discomfort to patients using them. Further, by improving the accuracy of initial sizing, expenses are reduced.

An important aspect of this invention is that both overall urethral length and the interballoon urethral segment length must be taken into consideration. Also, changes caused by filling a bladder are also taken into consideration.

It should be appreciated by those of ordinary skill in the art that the step of instilling the bladder with a volume of sterile saline through the drainage/filling lumen 38 of the urethral sizing catheter 14, and then occluding the drainage lumen with a plug 38b before the patient is observed and measured, is an important and

new step in the sizing method. In this regard, prior art sizing catheters measured patients without filling their bladders. Many patients, because they are incontinent, were not use to having filled bladders and were unable to tolerate this. Thus, the sizing catheter of this invention provides information to an operator as to the patients level of tolerance. Similarly, the operator can use the sizing catheter for "exercising" a patient's bladder by filling and voiding the bladder to prepare the patient for using an indwelling urethra catheter. Also, by filling the bladder prior to taken an overall clinical urethral length measurement, a more accurate clinical length is determined. That is, filling a bladder can influence catheter length.

The invention claimed is:



1. A method of determining a clinical length of an indwelling urethral catheter of a type for extending from a male's bladder to close to his penile meatus without extending outside his body, said method comprising the steps of:

determining the male's interballoon urethral segment length, from his bladder to a bulbus urethra immediately downstream of what remains of his prostate gland;

choosing an elongated urethral sizing catheter having a bladder balloon at an upstream end thereof and a urethral anchoring cuff balloon spaced along the urethral sizing catheter in a downstream direction from the bladder balloon a balloon spacing which corresponds to the patient's interballoon urethral segment length, said urethral sizing catheter having an overall length substantially greater than an overall length of the patient's urethral tract;

inserting the urethral sizing catheter into the patient's urethral tract and inflating the bladder balloon in the patient's bladder and the urethral anchoring cuff balloon in the patient's bulbus urethra so that the urethral sizing catheter extends outside of the patient's penile meatus;

noting the position of the penile meatus on the urethral sizing catheter; and,

choosing an indwelling urethral catheter from a set of indwelling urethral catheters -- with each indwelling urethral catheter of the set having different balloon spacings than other indwelling urethral catheters of the set -- having a balloon spacing corresponding to the interballoon urethral segment length of the male and having a clinical length which is less than the length of the male's urinary tract.

2. A method of choosing an indwelling urethral catheter as in claim 1 wherein said set of indwelling catheters

5 includes urethral catheters having approximately the same clinical length but having at least three substantially different balloon spacings corresponding to a normal prostate gland, an enlarged prostate gland, and a diminished prostate gland.

5 3. A method as in claim 2 wherein is further included the step of filling said patient's bladder with liquid through a drainage/filling lumen of said urethral sizing catheter before noting the position of the penile meatus on said urethral sizing catheter.

4. A method as in claim 3 wherein the position of said penile meatus along said catheter is noted while the patient is in a prone position, a sitting position, and a standing position.

5 5. A method as in claim 1 wherein is further included the step of filling said patient's bladder with liquid through a drainage/filling lumen of said urethral sizing catheter before noting the position of the penile meatus on said urethral sizing catheter.

6. A method as in claim 5 wherein the position of said penile meatus along said catheter is noted while the patient is in a prone position, a sitting position, and a standing position.

7. A method as in claim 1 wherein said urethral sizing catheter has graduated markings along its length.

8. A set of urethral sizing catheters each urethral sizing catheter of the set being longer than most patient's urethral tracts, each urethral sizing catheter of the set having a bladder balloon at an upstream end

5           thereof and a urethral anchoring cuff balloon spaced  
therefrom a balloon spacing along the urethral sizing  
catheter in a downstream direction, with each urethral  
sizing catheter of the set having a different balloon  
10           spacing from the other urethral sizing catheters in the  
set.

9.   A set of urethral sizing catheters as in claim 8  
wherein said set includes at least three sizing  
catheters, with each sizing catheter having a different  
balloon spacing.

10.   A set of urethral sizing catheters as in claim 9  
wherein all urethral sizing catheters have graduated  
markings therealong.

11.   A set of urethral sizing catheters as in claim 8  
wherein all urethral sizing catheters have graduated  
markings therealong.

12.   A set of urethral sizing catheter as in claim 8  
wherein each urethral sizing catheter of the set  
includes a drainage/filling lumen for voiding and  
filling a bladder and a means for occluding the  
5           drainage/filling lumen.

13.   A set of a plurality of indwelling urethral  
catheters, each urethral catheter of the set including  
a bladder balloon at an upstream end thereof and an  
urethral anchoring cuff balloon spaced along the  
10           indwelling urethral catheter in a downstream direction  
from the bladder balloon a balloon spacing which  
corresponds to a patient's interballoon urethral segment  
length, each indwelling urethral catheter of said set  
15           having approximately the same length, but each having a  
different balloon spacing from the other indwelling

urethral catheters of the set.

14. A set of indwelling urethral catheters as in claim 12 wherein there are indwelling urethral catheters in the set having three different balloon spacings corresponding to three different prostatic urethral spacings.

15. A set of indwelling urethral catheters as in claim 13 wherein the three prostatic urethral spacings respectively correspond to interballoon urethral segment lengths for patients with: a normal prostate gland, an enlarged prostate gland, and a removed prostate gland.

16. A method of determining a clinical length of an indwelling urethral catheter of a type for extending from a male's bladder to close to his penile meatus without extending outside his body, said method comprising the steps of:

choosing an elongated urethral sizing catheter having a bladder balloon at an upstream end thereof, said urethral sizing catheter having an overall length substantially greater than an overall length of the patient's urethral tract;

inserting the urethral sizing catheter into the patient's urethral tract and inflating the bladder balloon in the patient's bladder with a downstream end the urethral sizing catheter extending outside of the patient's penile meatus;

filling said patient's bladder with liquid through a drainage/filling lumen of said urethral sizing catheter before noting the position of the penile meatus on said urethral sizing catheter;

noting the position of the penile meatus on the urethral sizing catheter as corresponding to the length of the male's urinary tract; and,

choosing an indwelling urethral catheter having a clinical length which is less than the length of the male's urinary tract as determined from the urethral sizing catheter.

## AMENDED CLAIMS

[received by the International Bureau on 03 June 1998 (03.06.98)  
original claims 1-16 replaced by amended  
claims 1-17 (8 pages)]

1. A method of determining a clinical length of an  
indwelling urethral catheter of a type for extending  
from a male's bladder to close to his penile meatus  
without extending outside his body, said method  
5 comprising the steps of:

determining the male's urethral segment length,  
from his bladder to a bulbous urethra immediately  
downstream of what remains of his prostate gland;

choosing an elongated urethral sizing catheter  
10 having a bladder expandable retainer at an upstream end  
thereof and a urethral expandable retainer spaced along  
the urethral sizing catheter in a downstream direction  
from the bladder expandable retainer an expandable-  
retainer spacing which corresponds to the patient's  
15 urethral segment length, said urethral sizing catheter  
having an overall length substantially greater than an  
overall length of the patient's urethral tract with  
graduation indicia thereon;

inserting the urethral sizing catheter into the  
20 patient's urethral tract and expanding the bladder  
expandable retainer in the patient's bladder and the  
urethral expandable retainer in the patient's bulbous  
urethra so that the urethral sizing catheter extends

outside of the patient's penile meatus;

noting the position of the penile meatus on the urethral sizing catheter relative to the graduation indicia and thereby determining a desired length for an  
5 indwelling urethral catheter; and,

choosing an indwelling urethral catheter having a desired length and having an expandable-retainer spacing corresponding to the urethral segment length of the male and having a clinical length which is less  
10 than the length of the male's urinary tract.

2. A method as in claim 1 wherein said said indwelling catheter is chosen from a set of indwelling catheters which includes urethral catheters having approximately a same clinical length but having at  
15 least three substantially different expandable-retainer spacings corresponding to a normal prostate gland, an enlarged prostate gland, and a diminished prostate gland.

3. A method as in claim 2 wherein is further  
20 included the step of filling said patient's bladder with liquid through a drainage/filling lumen of said urethral sizing catheter before noting the position of

the penile meatus on said urethral sizing catheter.

4. A method as in claim 3 wherein the position of said penile meatus along said urethral  
5 sizing catheter is noted while the patient is in at least two of the following positions: a prone position, a sitting position, and a standing position.

5. A method as in claim 1 wherein is further included the step of filling said patient's bladder  
10 with liquid through a drainage/filling lumen of said urethral sizing catheter before noting the position of the penile meatus on said urethral sizing catheter.

6. A method as in claim 5 wherein the position of said penile meatus along said urethral  
15 sizing catheter is noted while the patient is in at least two of the following positions: a prone position, a sitting position, and a standing position.

7. A method as in claim 1 wherein said  
20 sizing catheter is chosen from a set of urethral sizing catheters with each of said sizing catheters of the set having a different expandable-retainer spacing than



that of other sizing catheters of the set and each of said urethral sizing catheters of the set of urethral sizing catheters having graduated markings along its length..

5                   8.   A urethral-catheter system comprising a urethral sizing catheter for measuring a distance from a patient's bulbous urethra to the patient's penile meatus and an indwelling urethral catheter for controlling flow of urine through the patient's urethra  
10 with a valve therein, wherein;

the urethral sizing catheter has a shaft formed of non-separable parts which is longer than most patients' urethral tracts, the urethral sizing catheter having a bladder expandable retainer at an upstream end of the  
15 shaft, an urethral expandable retainer spaced from the bladder expandable retainer a specified sizing-catheter expandable-retainer spacing, and graduation indicia along the shaft downstream of the expandable retainers;

the indwelling urethral catheter including a valve  
20 therein for controlling urine flow through the indwelling urethral catheter, a bladder expandable retainer at an upstream end thereof, and a urethral

expandable retainer spaced along the indwelling urethral catheter in a downstream direction from the bladder expandable retainer an indwelling expandable-retainer spacing which approximates that of the sizing-catheter expandable-retainer spacing of the sizing catheter.

9. A urethral-catheter system as in claim 8 wherein said urethral sizing catheter is one of a set of urethral sizing catheters and said indwelling urethral catheter is one of a set of indwelling urethral catheters, each of said sets including at least three respective sizing and indwelling catheters, with each of the at least three respective sizing and indwelling catheters having a different expandable-retainer spacing than other members of the set.

10. A urethral-catheter system as in claim 9 wherein all three of the urethral sizing catheters have graduated markings along the shafts thereof to measure the location of a penile meatus.

11. A urethral-catheter system as in

claim 8 wherein each of the urethral sizing catheters has graduated markings along the shafts thereof to measure the location of a penile meatus.

12. A urethral-catheter system as in claim  
5 8 wherein the shaft of the urethral sizing catheter includes a drainage/filling lumen for voiding and filling a bladder and a means for selectively occluding and voiding the drainage/filling lumen.

13. A urethral-catheter system as in claim  
10 12 wherein said means for selectively occluding can be activated for occluding and voiding from a downstream end portion of said shaft.

14. A set of a plurality of indwelling  
urethral catheters, each urethral catheter of the set  
15 including a bladder expandable retainer at an upstream end thereof and a urethral expandable retainer spaced along the indwelling urethral catheter in a downstream direction from the bladder expandable retainer an expandable-retainer spacing which corresponds to a  
20 patient's prostatic urethral segment length, each indwelling urethral catheter of said set having approximately the same length, but each having a different expandable-retainer spacing from the other indwelling urethral catheters of the set.

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15. A set of indwelling urethral catheters as in claim 14 wherein there are indwelling urethral catheters in the set having three different expandable-retainer spacings corresponding to three different prostatic urethral segment lengths.

16. A set of indwelling urethral catheters as in claim 15 wherein the three prostatic urethral segment lengths respectively correspond to prostatic urethral segment lengths for patients with: a normal prostate gland, an enlarged prostate gland, and a removed prostate gland.

17. A method of determining a clinical length of an indwelling urethral catheter of a type for extending from a male's bladder to close to his penile meatus without extending outside his body, said method comprising the steps of:

choosing an elongated urethral sizing catheter having a bladder expandable retainer at an upstream end thereof, said urethral sizing catheter having an overall length substantially greater than an overall length of the patient's urethral tract;

inserting the urethral sizing catheter into the patient's urethral tract and inflating the bladder expandable retainer in the patient's bladder with a downstream end the urethral sizing catheter extending outside of the patient's penile meatus;

filling said patient's bladder with liquid through a drainage/filling lumen of said urethral sizing catheter before noting the position of the penile meatus on said urethral sizing catheter;

noting the position of the penile meatus on the

urethral sizing catheter as corresponding to the length of the male's urinary tract; and,

choosing an indwelling urethral catheter having a clinical length which is less than the length of the male's urinary tract as determined from the urethral sizing catheter.

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FIG. 1

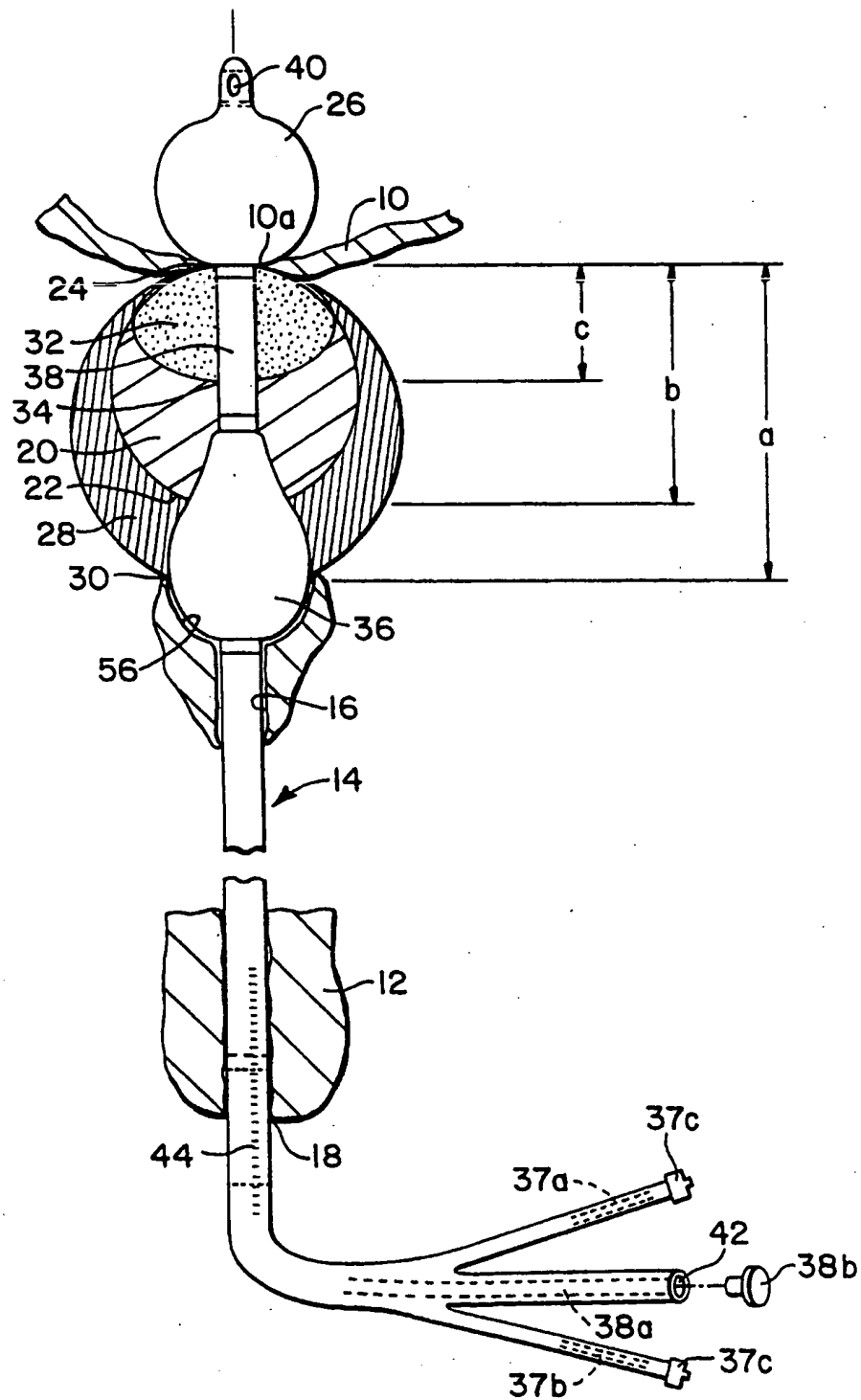
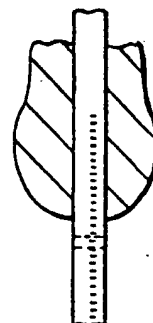
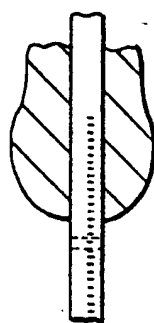
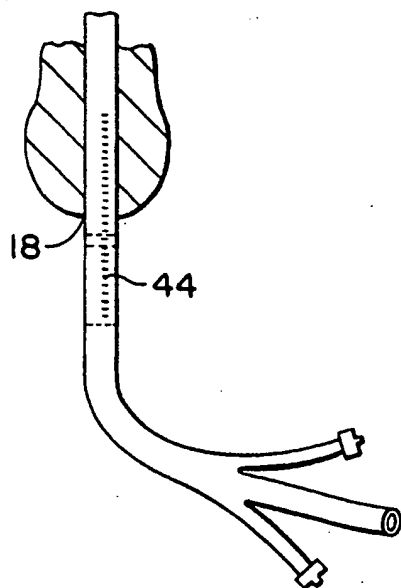
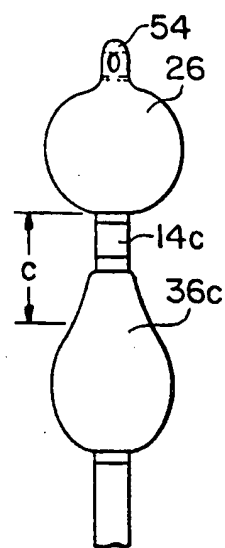
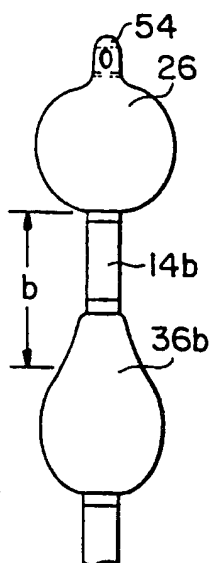
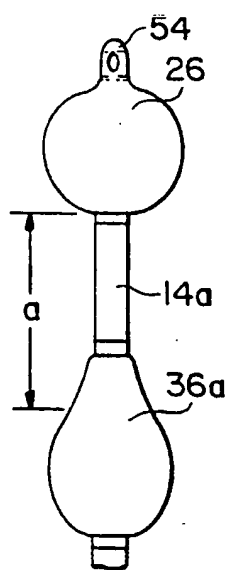


FIG. 2A

FIG. 2B

FIG. 2C



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FIG. 3A

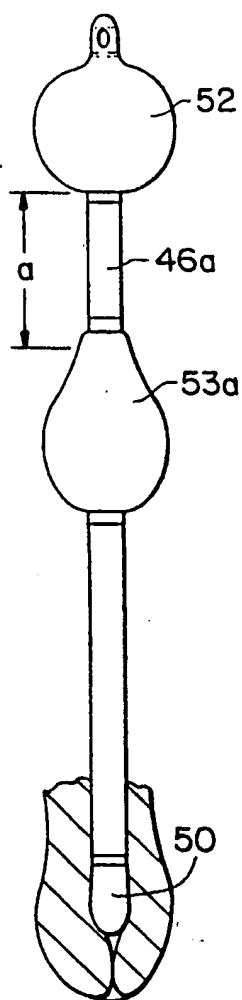


FIG. 3B

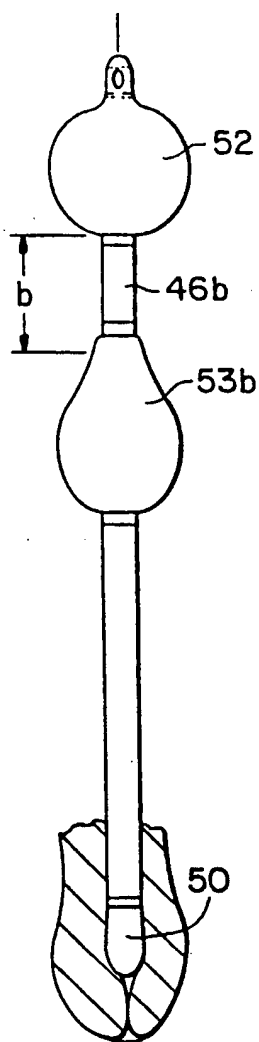
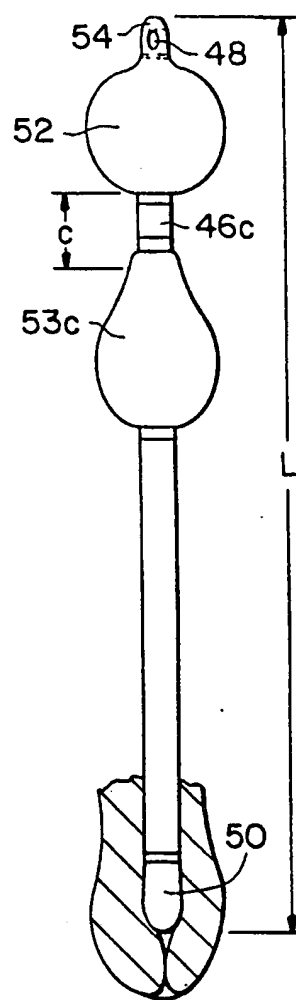


FIG. 3C





## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US97/08396

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : A61M 29/00

US CL : 604/96

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 604/49, 53, 54, 96-103

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS, STIC

Search Terms: method, catheter, urethra, balloon

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| Y         | US 4,932,938 A (GOLDBERG et al.) 12 June 1990, Abstract.                           | 8-15                  |
| A         | US 4,813,935 A (HABER et al.) 21 March 1989, Abstract                              | 1-16                  |
| A         | US 5,002,558 A (KLEIN et al.) 26 March 1991, Abstract.                             | 1-16                  |

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

|   |  |
|---|--|
| * Special categories of cited documents:  | *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention  |
| *A* document defining the general state of the art which is not considered to be of particular relevance  | *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone   |
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| *P* document published prior to the international filing date but later than the priority date claimed  |  |

Date of the actual completion of the international search

31 JULY 1997

Date of mailing of the international search report

26 AUG 1997

Name and mailing address of the ISA/US  
Commissioner of Patents and Trademarks  
Box PCT  
Washington, D.C. 20231

Authorized officer

DEBORAH BLYVEIS

Facsimile No. (703) 305-3230

Telephone No. 308-2110